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# (12) UK Patent Application (19) GB (11) 2 177 336 A

(43) Application published 21 Jan 1987

(21) Application No 8614863

(22) Date of filing 18 Jun 1986

(30) Priority data

(31) 8515468

(32) 19 Jun 1985

(33) GB

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(51) INT CL

B23K 20/12

(52) Domestic classification (Edition I):

B3R 10 14 15 17B 3

U1S 2055 B3R

(56) Documents cited

EP A2 0152199 EP A1 0102728

Welding-Metal Fabrication, Nov 1982, p.449

(58) Field of search

B3R

Selected US specifications from IPC sub-class B23K

(54) Improvement in electrical connections

(57) Electrical connections between an insulated multi-core conductor (4) and a terminal such as the head (1) of a pin of a jack are made by progressively applying a rotating wheel (6) to the conductor without removal of the insulation. This is displaced and the members of the core (3) are permanently bonded to the head (1) and to each other.

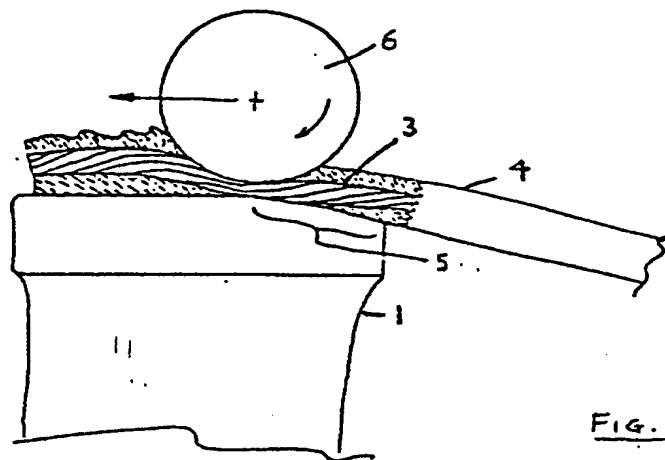


FIG. 2.

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## SPECIFICATION

### Improvement in electrical connections

5 This invention uses the process described in GB-A-1385473 and subsequent applications such as EP-A-152189 in which a high speed rotating wheel produces a bond at an interface between two surfaces. The wheel works on a "working surface" which is opposite the inter-  
10 face and is usually the opposed surface of one of the parts to be bonded. The process has now become known as "Luc welding".

This invention relates to an improved  
15 method of bonding an insulated electrical conductor directly to a second conductor, without prior removal of the insulation from the first conductor. The bond can for example be a weld or a reflow soldered joint.

20 The first conductor may be single or multicore wire, especially copper, or tinned copper with pvc or other organic insulation and the second conductor may be a metallic terminal in a jack or socket, or a busbar in an electric control cabinet. When the first conductor is a multicore wire there is particular advantage, because the multiple strands are spread and are bonded both to each other and to the second conductor, giving a strong  
25 and highly conductive joint.

The surface of the wheel used in the process simultaneously removes the insulating coating from the wire or displaces it from between the first and second conductors and  
35 bonds the wire to the second conductor. The direction of the wheel traverse motion relative to the wire may be along the axis of the wire or it may be at right angles to the axis. When the motion is along the axis, the second conductor will be preferably such that the surface which is to be welded approaches the first  
40 conductors in a gradual manner rather than suddenly. This may be achieved by bevelling an edge or by tapering the surface of the second conductor with respect to the path of the wheel such that it is further from the wheel periphery at the start of the weld than at the end of the weld.

An example of the invention is in the production of electrical plugs, whether for signals, power or other purposes, in which the second conductor is a metal component such as a male pin or female socket component.

In the case of typical mains power plug, brass pins to match the female power supply socket are provided with a hole for the end of the wire from which insulation has been removed and a screw to clamp it. Alternatively a threaded portion and nut may be provided.

60 In the improved device the subject of this invention, it is only necessary to provide a surface to which the first connector may be bonded, carry out the process and a permanent electrical connection is achieved without  
65 first removing the insulation. Since a single

multicore conductor will usually be bonded, the second conductor should have its edge nearest the approaching wheel bevelled to avoid damage to the first conductor when the wheel reaches the edge of the second conductor.

A particular advantage of connections using a multicore first conductor is that the individual wires in the first conductor are flattened out into a sheet and a high proportion of the individual wires are welded both to each other and to the second conductor thus improving the electrical connection compared with a round multicore conductor secured with a screw, which is prone to loosening with time and in which only the outer wires are in contact with the second conductor.

Such connections are particularly advantageous in moulded plugs since there is no need to have an expensive fastening for the wire as there is no need to disconnect it.

The accompanying drawings show in Figs. 1, 2 and 3 successive stages in the formation of a bond between a multicore conductor and a second conductor in the form of the head 1 of a jack e.g. a rectangular brass pin of a 13A domestic mains plug.

The head 1 of the brass pin has an upper surface 2 which acts as an anvil to a multicore copper conductor 3 insulated with a pvc sheath 4. The surface 2 of the brass pin is provided with a tapered portion 5.

A wheel 6 rotating at very high speeds is passed over the surface 2 such that the path of the wheel axis is parallel to the surface 2 and such that the conductor 3 lies between the periphery of the wheel 6 and the surface 2. The wheel may travel along the conductor, as shown in Fig. 2, or across it. As it progresses it displaces the pvc insulator 4 from around the multicore copper wires 3 such that the wires are both contacted by the high speed periphery of the wheel 6 and in metal to metal contact with the surface 2. The tapered portion 5 of the surface 2 ensures that pressure exerted on the multicore wires 3 due to their position between the wheel 6 and the surface 2 is only gradually applied and that there is no sudden change in the cross-section of the wires, thus greatly improving the strength of the weld produced.

After it has passed, Fig. 3, the wires are left spread on the anvil, most being bonded both to the anvil and to each other as indicated schematically in Fig. 3. Thus a strong and highly conductive joint is formed which is for example specially suitable for use in moulded-on (irremovable) mains jacks for domestic appliances.

## CLAIMS

1. A method of forming an electrical connection between an insulated conductor and a metallic terminal comprising placing the insulated conductor on the terminal as an anvil

and applying a wheel rotating at high speed onto the conductor to displace insulation from between the terminal and the conductor and to form a permanent conductive bond between the conductor and the terminal.

- 5  
2. A method according to claim 1 wherein the insulated conductor is a multi-core insulated lead and members of the core are bonded to each other and to the terminal by the action of the wheel.

- 10  
3. A method according to claim 1 or claim 2 wherein the terminal is the pin of a jack plug or the base of a socket.

- 15  
4. Methods according to claim 1 substantially as herein described with reference to the accompanying drawing.

5. An electrical connection formed by a method according to any one of the preceding claims.

Printed in the United Kingdom for  
Her Majesty's Stationary Office, Dd 3818935, 1987, 4235.  
Published at The Patent Office, 25 Southampton Buildings,  
London, WC2A 1AY, from which copies may be obtained.

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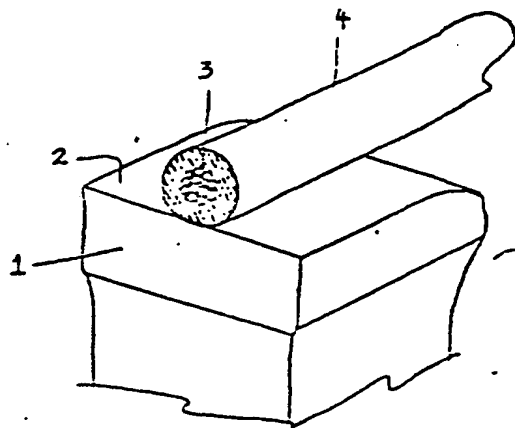


Fig. 1.

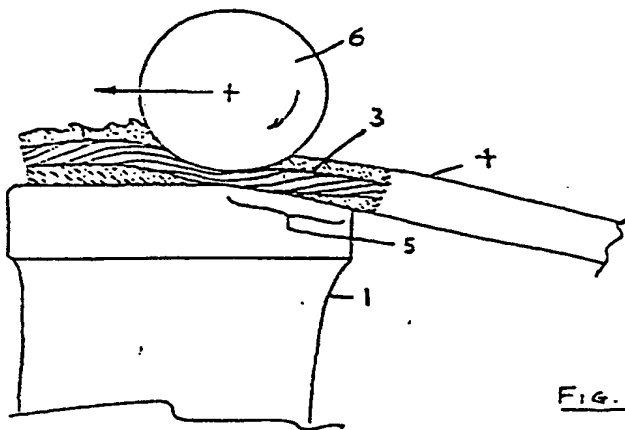


Fig. 2.

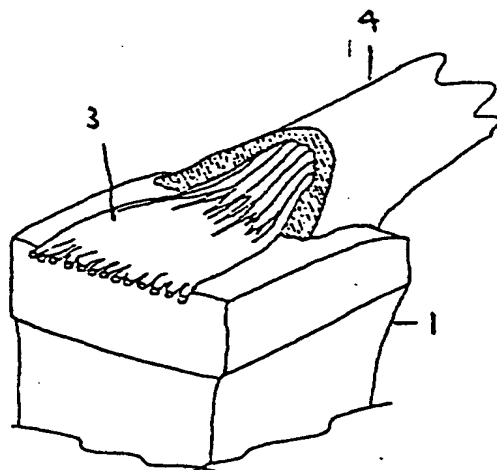


Fig. 3.